

Vol. 15, No. 6

PSYCHOLOGICAL REVIEW PUBLICATIONS

June, 1918

Psychological Bulletin

EDITED BY

SHEPHERD I. FRANZ, GOVT. HOSP. FOR INSANE

HOWARD C. WARREN, PRINCETON UNIVERSITY (*Review*)

JOHN B. WATSON, JOHNS HOPKINS UNIVERSITY (*J. of Exp. Psych.*)

JAMES R. ANGELL, UNIVERSITY OF CHICAGO (*Monographs*) AND

MADISON BENTLEY, UNIVERSITY OF ILLINOIS (*Index*)

WITH THE CO-OPERATION OF

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PUBLISHED MONTHLY BY THE

PSYCHOLOGICAL REVIEW COMPANY

NORTH QUEEN ST., LANCASTER, PA.,

AND PRINCETON, N. J.

AGENTS: G. E. STECHERT & CO., LONDON (2 Star Yard, Carey St., W. C.); PARIS (16, rue de Condé)

Entered as second-class matter January 21, 1904, at the post-office at Lancaster, Pa., under Act of Congress of March 3, 1879

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PSYCHOLOGICAL REVIEW COMPANY

Princeton, New Jersey

FOREIGN AGENTS: G. E. STECHERT & CO., London (1 Star Yard, Cary St., W. C.)
PARIS (16, rue de Condé)

THE
PSYCHOLOGICAL BULLETIN

THE USE OF INTELLIGENCE TESTS IN THE ARMY

BY L. M. TERMAN

Stanford University

"The war will be won through a judicious expenditure of brain power rather than a stupendous expenditure of man power," General Crowder, in an interview quoted in the *Literary Digest*, September 14, 1918.

The Difference Between a Horde and an Army.—When Germany mobilized her army practically every man called to the colors had had two or more years of military training. In that time each man had demonstrated the type of work he was able to do and had been trained to do it. The army was already made. Each division had been organized to the last detail and supplied with its quota of trained officers, machine gunners, infantrymen, artillerymen, ammunition trains, bakers, cooks, teamsters, mechanics, chauffeurs, aviators, engineers, chemists, doctors, and labor battalions. The parts of the machine needed only to be assembled in order to begin work.

Contrast this situation with that in an American cantonment receiving each month perhaps twenty thousand men, from all walks of life, with every kind of training and experience, of all degrees of ability, and alike only in their universal ignorance of the science and art of modern warfare. Such a body of men is not an army; it is only the raw material for an army. It will only become an efficient army in proportion as each man is assigned to the kind of duty for which he is best fitted, and is trained in the performance of that duty. As long as it remains but an assembled horde, it could easily be vanquished by a trained army of a twentieth its size.

The Problem of Classification.—Before the horde can be trans-

formed into an army, two kinds of classification and selection are equally important and necessary: (1) on the basis of previous occupation, and (2) on the basis of mental ability. The former will be treated in a later chapter. The importance of selection on the basis of mental ability is enhanced by the fact that the majority of men who enter the army must be assigned to duties which have little in common with the occupations they have mastered in civil life. They must learn their new tasks from the beginning, and the speed with which they can do this will depend largely upon their intelligence. Some of these tasks require a high degree of intelligence for rapid mastery, others relatively little. Hence, the necessity of some kind of intellectual sifting. The general purpose of such sifting is two fold: (1) to aid in placing each man where his military usefulness will be greatest, and (2) to reduce the time necessary for organizing and training units.

Mental Tests for Millions.—The preceding chapter has shown us that the ideal way to bring about such a mental classification is by means of intelligence tests. Immediately after the declaration of war by the United States the President of the American Psychological Association appointed a "Committee on the Psychological Examination of Recruits." This committee decided to recommend the mental examination of every soldier, and within six weeks had prepared methods adequate for the huge task of testing millions of men.

The intelligence scale devised for the purposes embodied the following important features:

1. It permitted "group examining" so that one examiner could test several hundred men in less than an hour.
2. The procedure in giving the tests was so minutely laid down that anyone of a hundred examiners testing a group would get the same results.
3. The test questions were ingeniously arranged so that practically all could be answered without writing, by merely drawing a line, crossing out or checking.
4. By the use of scoring stencils the personal equation was entirely eliminated from the grading of papers. When the stencil is placed upon the paper it shows instantly the number of correct answers. The test papers are in fact scored by enlisted men who know nothing about psychology.
5. Coaching was guarded against by making five different "forms" of the scale, each "form" differing entirely in substance

from every other "form," yet all exactly equal in difficulty and alike psychologically.

After a preliminary trial of the tests on 4,000 soldiers they were adopted for use and further trial in four National Army Cantonnements. By January, 1918, some 80,000 men and officers had been tested. An official investigation of the results in these four camps indicated such large value for the psychological work that it was ordered extended to include the testing of the entire enlisted personnel of the Army. At the same time a Division of Psychology was established in the Office of the Surgeon General, commissioned officers were provided to carry out the program, and a School of Military Psychology for the training of Psychological Officers was established at Fort Oglethorpe, Georgia. By October 1, 1918, approximately one and a half million men and officers had been tested and classified according to intelligence, and tens of thousands of assignments or promotions had been made wholly or in part on the basis of the intelligence ratings. Intelligence ratings have proven of military value in the following particulars:

1. In the discovery of men whose superior intelligence recommends their advancement.
2. In the prompt selection and assignment to Development Battalions of men who are so inferior mentally that they would retard the training of other soldiers.
3. In forming organizations of uniform mental strength where such uniformity is desired.
4. In forming organizations of superior mental strength where such superiority is demanded by the nature of the work to be performed.
5. In selecting suitable men for various army occupations or for special training in colleges or technical schools.
6. In eliminating from the army those men whose low grade intelligence renders them either a burden or a menace to the service.

Three Systems of Tests.

The general intelligence tests as used in the U. S. Army include three types.

1. *Alpha*, a group test for men who read and write English. The Alpha test measures a man's ability to comprehend, to remember and follow instructions, to discriminate between relevant and irrelevant answers to common sense questions, to combine related ideas into a logical whole, to discover by logical reasoning the plan

present in a group of abstract terms, to keep the mind directed toward a goal without yielding to suggestion, and finally, to grasp and retain miscellaneous items of information. It is so arranged that its 212 questions are answered by checking or underlining, thus permitting the answers to be scored by the use of stencils.

2. *Beta*, a group test for foreigners and illiterates. The Beta test is given to all men who cannot understand or read English well enough to take the Alpha test. Success in it does not depend upon knowledge of English, as the instructions are given entirely by pantomime and demonstration. Like Alpha, Beta measures general intelligence, but it does so through the use of concrete materials instead of by the use of written language. It measures particularly the ability to understand instructions given in pantomime, degree of foresight and ingenuity, the ability to discover a plan in given materials, the power to form arbitrary associations quickly, the ability to find likenesses and differences among printed symbols, to detect absurdities, to remember, and to combine related items into a logical whole. Like Alpha, its answers require no writing and are scored by stencils.

3. *Individual Tests*.—Three forms of individual tests are used in the examination of men who fail to pass the group tests. They are The Yerkes-Bridges Point Scale, The Stanford-Binet Scale, and The Performance Scale. The Performance Scale was devised especially for testing foreign subjects. The instructions are given by signs and demonstration, and a high score may be earned by one who does not know a word of English.

Procedure

All enlisted men are given either Alpha or Beta according to their degree of literacy. Those who fail in Alpha are given Beta, and those who fail to pass either of the group tests are given an individual test. Of whites, ordinarily about 75 per cent. receive their ratings on Alpha, about 20 per cent. on Beta, and only about 5 per cent. on an individual test. However, recommendation for rejection, discharge, or assignment to development battalion is not made on the result of a group test alone, but only after an individual test. This is a necessary precaution to prevent malingering.

Each group test takes a little less than an hour and can be given equally well to any number of men up to four or five hundred, according to available space. The individual test ordinarily takes from fifteen to thirty minutes, though in difficult cases an hour is occasionally necessary.

In all the examinations the greatest care must be taken to keep the conditions uniform, to put the men at their ease, and to encourage them to do their best. In this there is rarely any difficulty. Experience shows that the men take the test seriously but without undue nervousness. Attempts to cheat are not common.

Ratings

As a result of the tests each man is rated as A, B, C, C-, D-, D or E. The letter ratings of all the men are reported to the Personnel Office, are there copied on the qualification cards, and are then given to company commanders.

What the Letter Ratings Mean.—The rating a man earns furnishes a fairly reliable index of his ability to learn, to think quickly and accurately, to analyze a situation, to maintain a state of mental alertness, and to comprehend and follow instructions. The score is little influenced by schooling, for some of the highest records have been made by men who had never even finished the eight grades. The meaning of the mental ratings is as follows:

A. *Very Superior Intelligence.*—This grade is earned by only four or five soldiers out of a hundred. The "A" group is composed of men of marked intellectuality. "A" men are of high officer type when they are also endowed with leadership and other necessary qualities.

B. *Superior Intelligence.*—"B" intelligence is superior, but less exceptional than that represented by "A." The rating "B" is obtained by eight to ten per cent. of soldiers. The group contains a good many men of the commissioned officer type and a large amount of men of non-commissioned officer material.

C+. *High Average Intelligence.*—This group includes about fifteen to eighteen per cent. of all soldiers and contains a large amount of non-commissioned officer material with occasionally a man whose leadership and power to command fit him for commissioned rank.

C. *Average Intelligence.*—Includes about twenty-five per cent. of soldiers. Excellent private type with a certain amount of fair non-commissioned officer material.

C-. *Low Average Intelligence.* Includes about twenty per cent. While below average intelligence, "C-" men are usually good privates and satisfactory in work of routine nature.

D. *Inferior Intelligence.*—Includes about fifteen per cent. of soldiers. "D" men are likely to be fair soldiers, but are usually slow in learning and rarely go above the rank of private. They

are short on initiative and so require more than the usual amount of supervision. Many of them are illiterate or foreign.

D- and E. *Very Inferior Intelligence*.—This group is divided into two classes (1) "D-" men, who are very inferior in intelligence but are considered fit for regular service; and (2) "E" men, those whose mental inferiority justifies their recommendation for Development Battalion, special service organization, rejection, or discharge.

The immense contrast between "A" and "D-" intelligence is shown by the fact that men of "A" intelligence have the ability to make a superior record in college or university, while "D-" men are of such inferior mentality that they are rarely able to go beyond the third or fourth grade of the elementary school, however long they attend. In fact, most "D-" and "E" men are below the "mental ages" of ten years and at best are at the border-line of mental deficiency. Most of them are of the "moron" grade of feeble-mindedness. "B" intelligence is capable of making an average record in college, "C+" intelligence can not do so well, while mentality of the "C" grade is rarely equal to high school graduation.

Evidence that the Tests Measure a Soldier's Value to the Service.—It has been demonstrated that the intelligence ratings are very useful in indicating "soldier value." Such evidence as the following is typical:

1. Commanding officers of ten different organizations representing various arms in a camp were asked to designate: (a) The most efficient men in the organization; (b) Men of average value; (c) Men so inferior that they were "barely able" to perform their duties.

The officers of these organizations had been with their men from six to twelve months and knew them exceptionally well. The total number of men rated was 965, about equally divided among "best," "average," and "poorest." After the officers' ratings had been made, the men were given the psychological tests. Comparison of test results with officers' ratings showed:

(a) That in every organization except one, the average score of the "best" group was approximately *twice* as high as the average score of the "poorest" group.

(b) That of men testing below C-, 70 per cent. were classed as "poorest" and only 4.4 per cent. as "best";

(c) That of men testing above C+, 15 per cent. were classed as "poorest" and 55.5 per cent. as "best."

(d) That the man who tests above C+ is about fourteen times as likely to be classed "best" as the man who tests below C-.

(e) That the per cent. classed as "best" in the various letter groups increased steadily from 0 per cent. in D- to 57.7 per cent. in A, while the per cent. classed as "poorest" decreased steadily from 80 per cent. in D- to 11.5 per cent. in A.

Many investigations of this kind have been made, and always with results similar to those just quoted. Considering that the low value of a soldier may have many other causes besides inferior intelligence, such findings are very significant.

2. Where commissioned officers have been selected on the basis of trying out and "survival of the fittest" it is ordinarily found that about 80 per cent. are of the A or B grade, and only about 5 per cent. below the C+ grade. Of non-commissioned officers chosen by this method, about 75 per cent. are found to grade A, B, or C+, and only 5 per cent. below C. Moreover, there is a gradual rise in average score as we go from privates up through the ranks of privates first class, corporals, sergeants, sergeants first class, O.T.S. students, and commissioned officers. This is seen in the following table:

PER CENT. EARNING EACH LETTER RATING

Various Groups (Whites)	D or E	D	C-	C	C+	B	A	A and B
8,819 commissioned officers	0.0	0.01	.25	2.92	13.8	34.6	48.4	83.
9,240 O.T.C. candidates..	0.0	0.14	.98	6.16	19.5	36.4	36.8	73.2
3,393 sergeants.....	0.0	1.05	4.05	14.2	27.3	32.5	20.9	53.4
4,023 corporals.....	0.0	1.33	7.33	20.33	31.3	26.	13.7	39.7
81,114 literate privates...	0.22	10.24	21.48	28.79	20.48	12.38	6.37	18.75
10,803 illiterate privates..	7.8	41.16	29.11	14.67	4.43	1.95	.52	2.47

3. Experience shows that "D" students admitted to Officers' Training Schools almost never make good, and that the per cent. of elimination among the "C-" and "C" students is several times as high as among "A" students. For example, in one of the Fourth Officers' Training Schools 100 per cent. of the "D" men were eliminated as unsatisfactory, 55 per cent. of the "C-" men, 14.8 per cent. of the "B" men, but only 2.7 per cent. of the "A" men. In another Fourth Officers' Training School 76.2 per cent. of the men rating below C were eliminated in the first six weeks, 51.5 per cent. of the "C" men, and none at all of the "A" or "B" men. These findings are typical.

The psychological ratings are valuable not so much because they make a better classification than would come about in the course of

time through natural selection, but chiefly because they greatly abbreviate this process by indicating *immediately* the groups in which suitable officer material will be found, and at the same time those men whose mental inferiority warrants their elimination from regular units in order to prevent the retardation of training. Speed counts in a war that is costing our country over fifty million dollars per day.

Directions for the Use of Intelligence Ratings.—The following instructions for the use of the intelligence ratings have been issued to the Personnel Adjutant of each camp:

1. The mental tests are not intended to replace other methods of judging a man's value to the service. It would be a mistake to assume that they tell us infallibly what kind of soldier a man will make. They merely *help* to do this by measuring one important element in a soldier's equipment; namely, intelligence. They do not measure loyalty, bravery, power to command, or the emotional traits that make a man "carry on." However, in the long run these qualities are far more likely to be found in men of superior intelligence than in men who are intellectually inferior. Intelligence is perhaps the most important *single* factor in soldier efficiency.

2. Commissioned officer material is found chiefly in the A and B groups, although of course not all high score men have the other qualifications necessary for officers. Men below C+ should not be accepted as students in Officers' Training Schools unless they are known to have exceptional power of leadership and ability to command.

3. Since more than one fourth of enlisted men rate as high as C+, there is rarely justification for going below this grade in choosing non-commissioned officers. This is especially the case in view of the likelihood of promotion from non-commissioned to commissioned rank. Even apart from considerations of promotion, it is desirable to avoid the appointment of mentally inferior men (below C) as non-commissioned officers. Several careful studies have shown that "C—" and "D" sergeants and corporals are extremely likely to be found unsatisfactory. The fact that a few make good does not justify the risk taken in their appointment.

4. Men below C+ are rarely equal to complicated paper work.

5. In selecting men for tasks of special responsibility the preference should be given to those of highest intelligence rating *who also have the other necessary qualifications*. If they make good they should be kept on the work or promoted; if they fail they should be replaced by men next on the list.

To aid in selecting men for occupational assignment, extensive data have been gathered on the range of intelligence scores found in various occupations. This material has been placed in the hands of the Personnel Adjutants for use in making assignments. It is suggested that as a rule, a man should not be assigned to an important army occupation unless his intelligence rating is as high as the average for all men in that occupation.

6. In making assignments from the Depot Brigade to permanent organizations it is important to give each unit its proportion of superior, average, and inferior men. If this matter is left to chance there will inevitably be "weak links" in the army chain.

Exception to this rule should be made in favor of certain arms of the service which require more than the ordinary number of mentally superior men; *e. g.*, Signal Corps, Machine Gun, Field Artillery and Engineers. These organizations ordinarily have about twice the usual proportion of "A" and "B" men and very much less than the usual proportion of "D" and "D—" men.

7. "D" and "D—" men are rarely suited for tasks which require special skill, resourcefulness or sustained alertness. It is also unsafe to expect "D," "D—" or "E" men to read or understand written directions.

8. Only high score men should be selected for tasks that require quick learning or rapid adjustments.

9. It should not be supposed that men who receive the same mental rating are necessarily of equal soldier worth. *A man's value to the service should not be judged by his intelligence alone.*

10. It is one of the most important functions of the psychological tests to aid the Personnel Office in the rapid sorting of the masses of men in the Depot Brigade. *In no previous war has so much depended on the prompt and complete utilization of the mental ability of the individual soldier.* It is expected, therefore, that the psychological ratings will be regularly used as an aid in the selection, assignment, and classification of men.

PROBLEMS

1. Has there ever been another war in which so much depended on the prompt and complete utilization of the intelligence of the individual soldier?

2. Does it seem unreasonable to believe that the best possible use of every soldier's ability might hasten by several months the country's attainment of maximum military efficiency? Assuming

for a basis of discussion that it would make a difference of three months, indicate the possible value of such a saving of time in terms of war costs and chances of making the victory complete.

3. In view of the fact that one fourth of the privates in an average unit test as high as C+, B, or A, what would be the probable effect of having 40 per cent. of the non-commissioned officers of a grade below C? (An actual situation.)

4. What are the relative values of the following qualities in an officer's equipment:

Muscular strength and agility;
Size;
Physical bearing;
Voice;
Leadership;
Character;
Intelligence.

Which of the first six traits are most likely to be associated with superior intelligence?

5. A camp Personnel Officer is asked to supply 100 auto mechanics. Examination of the files of the Qualification Cards shows that there are 360 men in the camp classified as auto mechanics, with intelligence ratings as follows:

D-	D	C-	C	C+	B	A
4	21	53	98	107	58	17

How would you select the men for assignment? (Personnel Adjutants are constantly faced with such problems in selecting men for army occupations.)

6. Show the value of a certain amount of leveling up of units. Suppose the defense of an important sector has been entrusted to a regiment which is made up largely of "D" and "D-" men. What would probably happen in case of an offensive by the enemy?

How would you treat such inequalities in mental strength as are shown in the following "best" and "poorest" companies of a Depot Brigade?

	D-						
	or E	D	C-	C	C+	B	A
Best	0%	4%	5%	21%	28%	26%	16%
Poorest	4%	19%	18%	29%	19%	9%	2%
			Best	Poorest			
			Grades below C-,	4%	23%		
			Grades above C+,	42%	11%		

7. Is it fair to judge a company commander entirely by the results he gets? How would this rule work in the two companies mentioned above?

8. Show various ways in which a feeble-minded soldier may be a burden to the service and a menace to his fellows.

9. Of 1,059,767 soldiers who were given a psychological examination between May 1 and September 1, 1918, 16,266 had a "mental age" of 8 years or less, and 7,359 a "mental age" below 7 years. Many men of this grade of mentality are so nearly normal in appearance that without an intelligence test, their mental deficiency would long escape detection. Try to estimate the total menace this many feeble-minded soldiers would constitute.

10. Assume that it costs \$2,500 to induct a soldier into the service, equip him, train him for eight months, and send him overseas; assume also that if he must then be returned as unfit, the government will be put to a further expense of \$2,500 in sending him home, mustering him out, and meeting insurance or pension obligation until his case is closed. On this basis, compute the money wasted by accepting 10,000 soldiers too inferior mentally to be used. Compare the total with the cost of giving intelligence tests to a million recruits at 25 cents per man.

HOW THE ARMY USES INDIVIDUAL DIFFERENCES IN EXPERIENCE¹

BY VARIOUS MEMBERS OF THE COMMITTEE ON THE CLASSIFICATION OF PERSONNEL IN THE ARMY.

The Headquarters Company of a 3-inch Field Artillery Regiment contains 187 enlisted men. Twenty-six of these are privates, first class. They are listed in Tables of Organization as follows: 1 in charge Regimental Commander's Scissors Instrument, 3 telephone operators, 9 scouts, 9 radio operators, 3 chauffeurs, 2 operators Battalion Commander's Scissors Instrument, 2 signalers.

An analysis of the work that these privates, first class, have to do shows that the first one must have had some experience as a draftsman, principally as a detailer; the next three must have had some experience in repairing telephone switchboards and be able to operate such a switchboard; three of the nine scouts must have

¹ Outlines of the Study of Human Action for the Students' Army Training Corps, Section 2.

had some experience as general electricians; the six radio operators must have had a good deal of experience as wireless operators; the three chauffeurs must be capable of handling light trucks; and the next two in the list must have had some experience as draftsmen—as detailers. Eighteen out of the twenty-six must be specially trained men. The remainder need not be specifically considered as the work that they must do can be learned relatively quickly by the average man, or is not a type of work that is learned by anyone in civil life.

Supposing that you were called upon to organize such a company as the above, how would you set about it? Let us consider three possibilities. If 187 enlisted men had already been assigned to your company, you might pick out 26 of them at random and start training them for these special positions. The disadvantages of such a course are obvious. First, there must be competent teachers for all these different tasks. Second, it would delay the organization of the company from three months to two years until the necessary training had been acquired. Third, after waiting all that time one of the men might be found unfit for the task, might be taken sick or die.

A more reasonable way of organizing the company would be to find out which men had had some experience in these various directions. But then perhaps the most exacting job would be left unprovided for. So the delay might be almost as serious in this case as in the first. The whole company would be held up until its organization was complete.

A third plan might be to select from the total number of men available in any camp just the men whose training and experience fitted the needs of your company.

Obviously this would be the most efficient plan. It saves time and money. It saves teachers and school facilities. More than all that it tends to place each man where he will be most at home, where he will feel that he as an individual is being of the greatest service in our great national task.

If you multiply the task of organizing this headquarters company of artillery by twenty-five thousand you will have a fair estimate of the personnel problems of organizing an army of 5,000,000.

For forty years the German Army had been organizing. Each man in it had been trained to do just the task that was expected of him in war. They were thoroughly drilled in the school of the

soldier, squad, company, etc., and in addition they were good draftsmen, wireless operators, electricians, chauffeurs, etc., just in the right proportion. All were assigned to the precise commands where they were needed.

In America there was nothing even remotely resembling such an organization of our civil population for war purposes. Under the urgent necessity of creating an organized army in the shortest possible time every scrap of training or experience that was needed by the Army was a national asset, if it could be found and correctly placed. Practically none of the men coming into the army had had military training so that had to be provided for all. But of the enlisted or selective service men, many had had more or less experience in many trades and professions that were needed somewhere by the army.

To discover these invaluable bits of specialized human experience and training—to catalogue and classify them—to make them available where they were most needed in the organization of the national army—that was a new and as our enemies thought a hopeless task.

It is solved in the following manner: (1) Every enlisted man is interviewed as he comes into the army and his educational, military and occupational history is recorded on a Qualification Card (see illustration). (2) The needs of each organization in the army are studied to determine just what kind of men coming from civil life will most quickly learn the new duties to be performed in that organization. (3) On the basis of such needs and the soldier's Qualification Cards, a Personnel Officer in each camp assigns the new men to their proper organization in the local camp. (4) Since various camps are oversupplied with certain types of men, such as miners from Pennsylvania or lumbermen from Washington, and undersupplied with other specialists, reports are made to Washington and these men are assigned from one camp to another in terms of the total supply and demand of the army. (5) A similar system has been established for the proper assignment of officers. It is now well recognized in France that an officer may be a complete failure in one unit and at one kind of work and become a great success when assigned to a different type of work. There they have effected an organization whereby only recently 2,200 officers who formerly would have been discharged and sent home have been reassigned with every expectation that they will make good.

The Soldier's Qualification Card.—The Qualification Card is the

1-17-1918

NAME **Kellogg** Print clearly **John** Wire name **Rec** Middle name **3d**

Age **30** Rank **64th** Vocational Assignment **Bridge Carpenter** Preferred **✓**

Occupation? **Timber & Concrete Construction** Years **50 1/2**

Just what did you do? **Heavy timber work and concrete construction, bridges, mill work, etc.**

Name of firm worked for? **A. J. Smith Construction Co**

Dept., Shop or Branch? **Chicago**

Address of firm? **528-11th St. Chicago** Weekly Wages **4.50**

Check once ✓ occupations in which he has some knowledge and ability; check twice ✓ / occupations at which he is skilled. After each checked occupation write number of years of experience. Put a circle around years of minor concurrent occupation.

1 Factory worker	19 Sheet metal worker	34 Photographer, still or moving	54 Automobile repairer	74 Laundry man
2 Farmer	20 Foundryman	35 Limberman	55 Machinist	75 Metal finisher
3 Laborer	21 Structural steel worker	36 Boatman, mariner	56 Millwright	76 Millwright
4 Lawyer, teacher	22 Chauffeur—auto	37 Accountant	57 Mule packer	77 Millwright
5 Business man	23 Chauffeur—truck	38 Shipyard worker	58 Mule packer	78 Millwright
6 Blacksmith	24 Auto mechanic	39 Stonemason	59 Mule packer	79 Millwright
7 Carpenter	25 Gasoline engine repairer	40 Baker or cook	60 Plumber	80 Mule packer
8 Concrete worker	26 Bricklayer	41 Butcher	61 Plumber	81 Plumber
9 Electrician	27 Horse, care of	42 Merchant, job's, wholesaler	62 Artist (camouflage)	82 Plumber
10 Electrician	28 Printer, letterpress	43 Draftsman	63 Artist (camouflage)	83 Plumber
11 Miner	29 Draftsman	44 Band musician	64 Artist (camouflage)	84 Plumber
12 Miner	30 Surveyor	45 Barber	65 Artist (camouflage)	85 Plumber
13 Painter	31 Telegrapher, in-cluding wireless	46 Printer worker	66 Artist (camouflage)	86 Plumber
14 Pipe fitter, operating man	32 Telephone repairman	47 Leather worker	67 Artist (camouflage)	87 Plumber
15 R. R. operating man	33 Telephone operator or repairman	48 Inspector	68 Artist (camouflage)	88 Plumber
16 Bookkeeper	34 Telephone operator or repairman	49 Inspector	69 Artist (camouflage)	89 Plumber
			70 Artist (camouflage)	90 Plumber
			71 Artist (camouflage)	91 Plumber
			72 Artist (camouflage)	92 Plumber
			73 Artist (camouflage)	93 Plumber
			74 Artist (camouflage)	94 Plumber
			75 Artist (camouflage)	95 Plumber
			76 Artist (camouflage)	96 Plumber
			77 Artist (camouflage)	97 Plumber
			78 Artist (camouflage)	98 Plumber
			79 Artist (camouflage)	99 Plumber
			80 Artist (camouflage)	100 Plumber

Details, 2d Best Occupation **Tracer, on floor for building construction**

Details, 3d Best Occupation **Canning factory, 3 years**

Details, 4th Best Occupation **also handled heavy timber**

Details, 5th Best Occupation **also handled heavy timber**

Details, 6th Best Occupation **also handled heavy timber**

Details, 7th Best Occupation **also handled heavy timber**

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Details, 99th Best Occupation **also handled heavy timber**

Details, 100th Best Occupation **also handled heavy timber**

SCHOOLING		No. of years		Graduated		Army Training School Certificate, etc.	
		Yes	No	Yes	No		
Common school	8	✓				Radio Course at U.M.C.C.	
High school	4	✓				Chicago School 10 weeks per week	
Trade, Night or Business school	1					Subjects of Specialization	
College or University						Drafting	
Technical College							
Name of College, Trade or Technical College attended		U.M.C.C. Night School		Age at end of schooling		19	
Can you carry on a conversation in French?		No		In German?		Yes	
Is any other language?		No		(Name them)		53	
<p>MILITARY EXPERIENCE</p> <p>Outline any previous military experience you have had, giving rank, years of service, and organization:</p> <p>1 year, National Guard, Chicago, Corp.</p>							
Branch of service or special duty preferred		Engineer		GENERAL			
Religious preference (Denomination)?		Presbyterian		Answer requested but not required			
Member of what fraternal, etc., organizations?		Elks, Carpenter Union					
Talent for furnishing public entertainment		Play mandarin					

Birthplace Chicago, Ill. How long in U.S.? 30 yrs.
 Give city and country U.S. or Province and Name of Foreign Country

of Father Lee, Maria, of Mother London, England
 Citizen. ☒ Taken out first papers. ☐ Non-citizen. ☐ Check one.

From Local Board 17 Chicago Ill.
 No. 383 Fed. Inv. No. 783 Army Serial No. 1,297,383
 Town, City or County

Signature of soldier John T. Hellogg
 Signature of interviewer Paul T. Smith
 Date 3/12/18 Rank Capt Inf R.C.

PRESENT ASSIGNMENT AND FUTURE CHANCES			
Company	Organization	Arm	Division
1 <u>B</u>	<u>311</u>	<u>Eng.</u>	<u>86</u>
2			
3			
4			
5			

REMARKS

basis of all personnel work in the army. Two different forms are used, one for officers and the second for soldiers. The card for soldiers is reproduced here. The other is similar.

This is not the place to enter into a detailed discussion of the soldier's Qualification Card. It is expected that a soldier who interviews recruits and makes out their cards will have received extensive instruction on the subject and will become familiar with most trades and their subdivisions together with the work performed by each. The subdivisions recognized in the army are given in an Index of Occupations issued by the War Department with a code symbol for each. For example, "Telephone man" is subdivided as follows:

Engineer.....	33 e
Operator.....	33 o
Switchboard installer.....	33 si
Switchboard repairman.....	33 s
Telephone installer	33 te
Troubleman, inside.....	33 t
Troubleman, outside.....	33 to
Wire chief.....	33 w

After the Qualification Card has been made out and checked it is turned over to a classifier who appraises the card and estimates how good the man is at each occupation and determines at which occupation the man should preferably be used. He marks the card accordingly. A tabber then affixes small celluloid tabs along the top of the card to represent the experience of the recruit. An orange tab placed at 6 indicates an apprentice machinist, a green tab placed at 6, represents a journeyman machinist. If the man is a journeyman at more than one trade, for example, as a machinist and a bricklayer, then a green tab is used at 6 because a machinist is more needed in the army than a bricklayer. But a black tab is placed 26 for bricklayer so that he may be found if he is needed.

After the cards have been tabbed, they are filed alphabetically by companies. When a requisition is received, say for experienced wireless operators, a file clerk looks down the cards of men available for transfer and notes each card which is green tabbed at 31. Only those cards are finally selected, however, which show that the men are wireless operators. Telegraphers and wireless constructors whose cards are also tabbed at 31 are saved for other requisitions. In this way men are located for every army need, providing trained men are available at any camp in the United States.

Tables of Army Occupational Needs.—Reference has already been made to the fact that the needs of each organization in the army are worked out so as to show just what kind of men in terms of civilian experience will learn the special duties of that organization in the shortest time. As an illustration the needs for the sappers and bombers platoon of the headquarters company of an infantry regiment are shown here. The code symbols refer to the Index of Occupations, previously mentioned.

SAPPERS AND BOMBERS PLATOON
HEADQUARTERS COMPANY INFANTRY REGIMENT

Table of Organization	Table of Corresponding Civilian Occupations		
	Number		Civil Occupation and Classification Symbol
Army Title	Journeyman (Green) Tab	Apprentice (Orange) Tab	
3 Sergeants (Bombers) ¹	I		Construction Foreman (50 ea) or Mine Foreman (12 f)
7 Corporals			
1 Sappers Section			
6 Bombers Section ¹		II	Miner (12 b, p, g)
11 Privates, 1st Class (Bombers Section) ¹			
27 Privates			
8 Sappers Section		I	Timberman (12 t)
		7	Digger (12 d) or Laborer (3)
		2	Brick or Stone Mason (26 s or g)
19 Bombers Section ¹			
Total	I	2I	22 Occupational Specialists 3 Others, leadership material 23 Not specified
48 Total enlisted			48 Total enlisted

¹ For 3-inch Stokes Mortars, Sergeants and Corporals should be men of mechanical aptitude; Privates, of superior strength and endurance.

Assignment.—1. Using the illustration of a Soldier's Qualification Card as a basis, interview a student and write up the interview as well as you can in the absence of a card upon which to record your data.

2. Using the Sappers and Bombers Platoon Table as a guide, prepare a Table of Occupational Needs for a Rifle Company in which you are now drilling. The Table of Organization for such a company calls for the following:

TRADE TESTS

- 1 1st Sergeant
 - 1 Mess Sergeant
 - 1 Supply Sergeant
 - 12 Sergeants
 - 4 Asst. to Platoon Commanders
 - 4 Riflemen
 - 4 Automatic Riflemen
 - 33 Corporals
 - 1 Company Clerk
 - 8 Automatic Riflemen
 - 8 Bombers
 - 8 Rifle Grenadiers
 - 8 Riflemen
 - 4 Cooks
 - 4 Mechanics
 - 2 Buglers
 - 64 Privates, 1st Class
 - 4 Agents and Signalmen
 - 16 Automatic-Rifle Gunners
 - 128 Privates
 - 16 Runners
- A total of 250 enlisted men.

TRADE TESTS

The qualification card as an index of fitness for any specialized task in the Army has one limitation as obvious as it is serious. Namely, the reports of men as to their degree of expertness in different trades is not always reliable. Some few recruits intentionally misrepresent their skill for the sake of getting a desirable place. Many lack proper standards of comparison. Perhaps the most obvious way to test a man's ability would be to take each man's statement at par and try him out for a month, raising or lowering his rating as a result of his performance. But this course would be enormously costly. Valuable machinery might be wrecked, lives might be lost. But even if there were no more tragic consequences the organization of an efficient army would be delayed and an inexcusable expense would be incurred.

The Personnel Office must handle and classify a constant stream of newly-enlisted men—sometimes over a thousand a day. Unless this office is willing to take a man's word or the record of his expe-

rience as sufficient evidence of his skill then some form of trade test is a necessity.

The idea of testing trade efficiency by examination is not new. Examinations of candidates for positions are given by firms, by professional boards, by Civil Service Commissions, etc. The use of trade tests to supplement the data of the qualification card differs from these familiar examinations, first, in the enormous variety of the trades, and secondly, in the quickness with which the tests must be applied.

When the problem of formulating tests was analyzed, it was seen that certain requirements were fundamental. A good trade test: (1) Must differentiate between the various grades of skill; (2) Must produce uniform results in various places and in the hands of individuals of widely different characteristics; (3) Must consume the least amount of time and energy consistent with satisfactory results.

While there are all degrees of trade ability among the members of any trade, it is convenient to classify them in a few main groups. Ordinarily the terms Novice, Apprentice, Journeyman and Journeyman Expert (or Expert) are employed. The Novice is a man who has no trade ability whatever, or at least none that could not be paralleled by practically any intelligent man. The Apprentice has acquired some of the elements of the trade but is not sufficiently skilled to be entrusted with any important task. The Journeyman is qualified to perform almost any work done by members of the trade. The Expert can perform quickly and with superior skill any work done by men in the trade.

It is sometimes desirable that the Trade Test should differentiate between the skill of different members of the same group; for instance, the journeyman group. It is essential that it should differentiate between the journeyman and the apprentice, and the apprentice and the novice. Trade tests devised to make this classification are of three kinds: oral, picture and performance.

The oral tests are most generally used because they are of low cost and they may be applied to a large number of men in a comparatively short time and without much equipment. They are satisfactory in determining the presence or absence of trade ability and in many instances determine the degree of ability with such accuracy that no other tests are required.

An oral Trade Test is developed by passage through twelve stages: (1) Priority, (2) assignment, (3) inquiry, (4) collection, (5) compilation, (6) preliminary sampling, (7) revision, (8) for-

mulation, (9) final sampling, (10) evaluation, (11) calibration, (12) editing.

Collecting the Trade Information.—From time to time the Personnel Organization of the Army submits to the Central Trade Test Office (Newark, N. J.) a list of trades which are required in Army use and for which tests are urgently needed. Upon the basis of this list, assignments are made to the field staff.

The field staff then makes thorough inquiry into the conditions of the trade. Their purpose is three-fold:

1. To determine the feasibility of a test in this trade. It was found, for example, that the trade of gunsmith was not a recognized trade, though there were gun repairers.
2. To determine the elements which require and permit of testing. In other words, can men be graded in it according to degrees of skill? In some trades it was found that the trade required simply the performance of a single set of operations and there were no gradations among the members of the trade.
3. To determine the kinds of tests that can be used. Some trades, such as truck driving and typewriting, are mainly matters of skill and for them performance tests are better than oral tests. Other trades, such as interior wiring and power plant operation, are mainly matters of knowledge. For these trades oral and picture tests are best.

After having discovered by inquiry that the trade is a recognized trade and can be tested, the field staff proceeds to collect all the information necessary from all available sources; for example, experts of the trade, trade union officials, literature of the trade, trade school authorities, employers and the like. They discover by this means what are the elements of the trade and what constitutes proficiency in it.

Compiling the Questions.—As a result of this collection of information they compile a number of questions, usually forty to sixty, each of which calls for an answer that shows knowledge of the trade. Experience in the formulation of such questions has shown that a good question meets the following requirements:

1. It must be in the language of the trade.
2. It must be a unit, complete in itself and requiring no explanation.
3. It must not be a chance question which could be answered by a good guess.
4. It must be as short as possible and must be capable of being answered by a very short answer.

5. It must not be ambiguous; the meaning must be unmistakable.

After the large number of questions originally formulated has been sifted down by application of these requirements they are used in a preliminary sampling on a number of tradesmen whose answers indicate the merits of the different questions and their grades from easy to difficult. In this sampling, tradesmen from different shops or plants are tried, in order to guard against specialized methods or modes of expression confined to a single locality. At least two examiners work on each set of questions at this stage to get the benefit of more than one point of view for revision.

This preliminary sampling affords a means of checking on the following points:

1. Is the test applicable to trade conditions?
2. Does the test represent good trade practice?
3. In what way can parts be profitably modified, supplemented or eliminated?
4. Does the test represent the whole range of the trade from the novice to the expert?
5. Is it a representative sampling of the whole range of trade processes?

In the light of the answers to these questions, the test is revised and is then ready to be formulated.

Final Sampling.—Final sampling is made by testing twenty men who are known to be typical representatives of each group (novice, apprentice, journeyman, expert). Among the novices tested are some highly intelligent and mature men of good general knowledge but no trade ability. Examinations are given to men whose record in the trade is already known and who are tested as nearly as possible in the same manner as men in the camps.

The results of this final sampling are now turned over to the Statistical Department of the Central Trade Test Office. The experts in this department make a careful study of the results and of the answers to each question. This enables them to determine the relative value of each individual question and the selection that makes a proper balance.

Evaluating the Test.—If a Trade Test is good, a known expert, when tested, is able to answer all, or nearly all, the questions correctly; a journeyman is able to answer the majority; an apprentice a smaller part, and a novice practically none. This does not mean that each question should be answered correctly by all the experts,

a majority of the journeyman, some apprentices but no novices. There are few questions which show this result. A graphic curve when plotted for such a question is almost a straight line (see Fig. 1, question 11).

Other types of questions, however, are more common. Some show a distinct line of cleavage between the novice and the apprentice. Novices fail, but apprentices, journeymen and experts alike

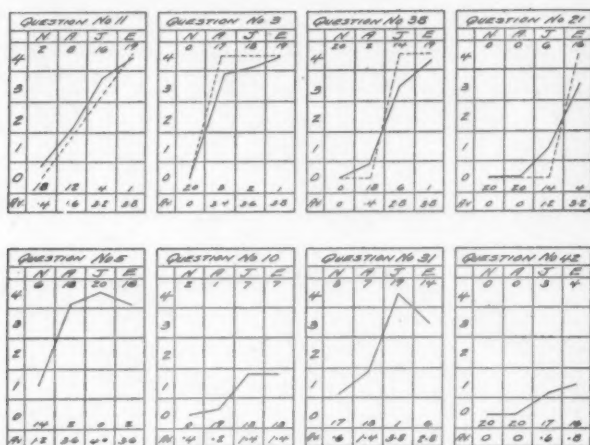


FIG. 1

This chart shows graphic representations of four good questions and four rejected questions. All are taken from the test shown in Fig. 2.

The dotted lines indicate ideal types; the solid lines show the questions as actually found in this test.

Question 11 approximates a gradual differentiation of groups.

Question 3 is a "Trade" Question, differentiating rather sharply between Novice and Tradesman.

Question 38 is an "Apprentice-Journeyman" Question, differentiating sharply between Novice and Apprentice on one hand and Journeyman and Expert on the other.

Question 21 is an "Expert" Question, its most marked differentiation being between Journeyman and Expert.

Question 5 is a poor trade question, Novices scoring high and Experts relatively low.

Questions 10, 31, and 42, are also poor questions which were finally rejected.

answer correctly. There are likewise questions that are answered correctly by nearly all journeymen and experts but only a few apprentices, and questions that only an expert can answer correctly (see Fig. 1, questions 3, 38 and 21).

Each type of question has its value in a good test. The main requirement is that the tendency of the curve should be upward; a question which is answered correctly by more journeymen than experts or more apprentices than journeymen is undesirable and is at once discarded. A proper balance is made of the others.

Calibrating the Test.—One task still remains; namely, that of calibrating the test. As each question is allowed four points, it becomes necessary to determine how many points should indicate an expert, how many a journeyman, etc. Obviously the way to do this is to note how many points were scored by the known experts and the known journeymen when they were tested. Ordinarily the expert scores higher than the journeyman and the journeyman higher than the apprentice. It frequently happens that a few journeymen score as high as the lowest of the experts and a few apprentices as high as the lowest of the journeymen. There are consequently certain overlappings between the classes (see Fig. 2).

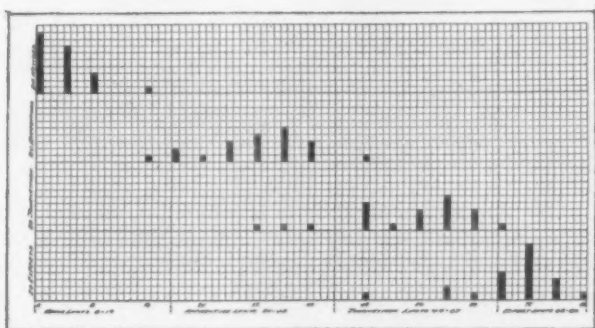


FIG. 2

This chart shows the distribution according to individual total scores of the 80 subjects used in standardization. Each square represents one man. The three vertical dash lines show the limits of the various groups as determined by the distribution of the men used in standardization. The limits shown are the ones finally used in Army testing.

In calibrating, the object is to draw the dividing line between classes so that the overlapping shall be as small as possible.

When these dividing lines, or *critical scores* as they are usually called, are established, the test is ready for distribution to camps.

Picture and Performance Tests.—Picture tests are made in practically the same way as oral tests. The peculiar characteristic of picture tests is that the questions making up the tests relate to illustrations of trade tools and appliances.

The performance tests are now being used in many trades for those who make a satisfactory showing in the oral or picture tests. These performance tests are devised by conference with experts in the trade. They consist of some apparently simple tasks that can be performed quickly and with a small amount of apparatus but that nevertheless indicate clearly the degree of skill of the performer. As a result of experience the following have been drawn up as the requirements for a good performance test:

1. It should require the smallest possible quantity of tools and materials and these should be capable of standardization;
2. A journeyman should not require more than 45 minutes to perform it;
3. It should be typical of the work required;
4. The operations should be exact so that a standard correct form of product is always obtainable.

Performance tests undergo much the same processes of sampling as do the oral and picture tests and they are calibrated in the same way. The principle followed here, as elsewhere, is that the value of a test lies not in its theoretical exactness but in its proved ability to pick out and classify correctly men of all degrees of skill within the trade. If the test does classify men in the groups in which they are known to belong, then it can be relied upon to classify correctly men about whom nothing is known in advance.

DEVELOPMENT BATTALIONS

The previous discussion of personal differences has shown that there is no such thing as a class of perfect men. In the draft there are all degrees of perfection but no two men are alike.

Just how good a man must be physically and mentally in order to be eligible for military service is a question that has received different answers at different periods of this war.

The most common practice is to accept a man for military service unless he has some specific disqualifying defect. The exact degree of defect that excludes him from service is governed by professional estimate of the military chances as laid down by special regulations. As the available man power of a country diminishes the level of acceptable human material tends to sink.

Formerly, unless a recruit could satisfy all the physical requirements he was not accepted for military duty. If a skilled court stenographer had flat feet so that he could not march with troops he

was rejected, even if the army was short of stenographers. The same was true of flat-footed truck drivers and auto repairmen, for which the demand far exceeds the supply.

Recently, however, War Department officials have come to realize the following interrelated facts: first, that even the United States has not such a vast supply of physically fit men that its army can be restricted to such men; secondly, that many duties in the army can be performed just as well by men with certain physical defects. In consequence, a limited service class has been established and is now being drawn from in larger and larger numbers in this country as it is in France and England.

The medical officer in dealing with Limited Service men now recognizes five classes of men as follows:

Class A: fit physically for any general military service.

Class B: (deferred remediable) fit for general military service when cured of a remediable disability.

Class C - 1: (limited service, general); not quite fit physically for general military service, but fit for military service in the Service of Supplies overseas, or general military service in the United States.

Class C - 2: (limited service, special); fit only for restricted military service in the United States in special capacity approved by Medical Officer.

Class D: unfit for any military service.

If men could be definitely placed in the above classes, and then be assigned on that basis plus their previous civilian experience, the personnel officer would have a comparatively simple task. But when we realize that a class C - 1 man may be flat-footed, or slightly deaf, or color-blind, or be lacking in a great variety of minor ways; that in addition he may be a college graduate or an illiterate; may be skilled, partly-skilled or not skilled at all in any one of several hundred occupations; then we come to realize that to place such men in the army is an exceedingly complicated duty. The work becomes still more difficult when it is necessary to assign such men on the basis of requisitions prepared by officers who know what they want but do not know the supply. Moreover, the assigning officer often has no opportunity to see the jobs that he is asked to fill, and must often work from his card records without seeing the recruits. Personnel work thus differs from that of the employment manager in a big business house who personally interviews all applicants.

In order that adequate personal attention be given limited service men, development battalions were created where all such men can be studied and built up when necessary. After careful classification by the surgeon and the personnel officer they may be assigned to appropriate military duties.

Soldiers may be transferred to the Development Battalion from the following sources:

(a) From divisional units, replacement organizations, etc., other than Depot Brigade. These are men who have been accepted as "fit for general military service," but in whom a disability has developed or been discovered since "muster in."

(b) From the Depot Brigade. These are men who have been accepted for general military service but in whose case observation for a period of from one week to one month has shown that a physical weakness exists which may or may not have been noted on the original examination, the nature of the defect making it desirable to transfer the men to a Development Battalion. Probably the majority of these will be men in need of graduated physical training to assure their fitness for general military service. Others will have permanent defects, placing them in the group for "special and limited service."

(c) Registrants, classed by Local Boards as fit for "Special and limited service in a named occupation or capacity," who are sent to camps as result of calls for this class of men, and who need special training or medical attention before they can be used to the best advantage.

It is evident that those with whom the cause of transfer to a Development Battalion is Physical Disability, may be suffering from a variety of pathological conditions. All men as they arrive in Development Battalions will be given special treatment according to their needs.

In each Development Battalion arrangements will be made for giving physical training to such convalescents as may be sent to the battalion for hardening.

When these men have received the necessary hardening, they will be returned to their organizations. Men from Base or other hospitals will not be attached to Development Battalions for physical training unless it is practically certain that they will be able to rejoin their commands within six weeks.

The Development Battalion is a part of the *Camp* Activities and its medical activities are under the general supervision of the Camp Surgeon.

ASSIGNMENT

1. Determine as well as you can where the following men could be utilized in the army, if at all. Be specific in describing the duty they are to perform.

(a) An undersized man who has had six years' experience as a freight agent on the New York Central R. R. at Albany, N. Y.

(b) A wagon freighter across the deserts of Nevada who has a wooden leg.

(c) A college graduate with one year's experience as secretary to a teaming and construction company, but has a weak heart.

(d) A flat-footed railroad engineer.

(e) A very near-sighted (partially corrected by glasses) telegrapher.

(f) An illiterate American farmer with flat feet.

(g) A balloon trapeze performer suffering from tuberculosis.

(h) A pipe-fitter of ten years' experience, minus the first two fingers of his right hand.

(i) An illiterate Russian section-hand who speaks only a few words of English with an intelligence score of B.

(j) The same but with an intelligence score of D.

2. What positions, if any, could be filled by limited service men in an infantry regiment? in an airplane squadron?

THE RATING SCALE

The general laws of individual differences apply to officers as well as to men. Officers differ among themselves in every conceivable way. Their good and bad qualities might be plotted on a distribution curve. The few best at the upper end are proper candidates for promotion. Conversely the few worst at the lower end of the curve may properly be considered for elimination.

One of the most embarrassing and difficult tasks that an officer has to perform is the professional rating of his colleagues. But it is a part of his duty to pick men for special tasks and in a more formal way to select men for promotion and advancement.

To consider all the relevant qualities, to give each its proper weight in estimating the excellence of the composite whole, to free oneself from bias and prejudice, requires more than honesty of purpose. It requires a system of organized judgments. Such a system is the rating scale. As a system its value is greater than the relative estimation of any group of qualities or persons to which

it is applied in any case. With proper modification the system is of universal application. It holds for the selection of non-commissioned officers, for officers material, for promotions, for the selection of students for special training—in short for the selection of men for every task where that selection must be made on the judgment of others.

As applied to officers the rating scale is a practical system by means of which an officer's capacity and fitness for promotion can be gauged quickly, accurately and with uniformity and justice.

The rating itself is a numerical expression of the degree in which an officer possesses the military qualifications deemed most essential: Physical fitness, intelligence, leadership, personal qualities, general value to the service.

The degree to which he meets these qualifications is determined by comparison with officers of the next higher rank. Every officer is measured in terms of the actual ability and performance of other officers.

Where instructions are followed closely the results show a high degree of accuracy and uniformity. The total average ratings of widely separated camps have shown a variation of less than one point in a hundred. The rating scale is a constant and reliable gauge of an officer's merit.

No system has yet been devised which so completely eliminates the personal equation or so justly determines merit. Because the Rating Scale calls attention separately to each of the several essential qualifications for an officer, it lessens the danger that judgments may be based on minor defects, with a corresponding disregard of important virtues.

It takes approximately twenty minutes to create a working scale and sixty seconds to make a rating.

Every officer should be rated by his immediate superiors.

How to Make the Scale.—Make a list of about a dozen officers of your own rank and not above the average age of officers of this rank. They should be men with whom you have served or with whom you are well acquainted. Include officers whose qualifications are poor or mediocre as well as those who are highly efficient. This list serves merely as a convenient reservoir of names; the names actually used in the scale may include others.

Look over your list from the viewpoint of physical qualities only. Disregard every characteristic of each officer except the way in which he impresses his men by his physique, bearing, neat-

ness, voice, energy and endurance. Select that officer who surpasses all the others in this qualification and enter his name on the line marked highest under physical qualities. Now select the one who most conspicuously lacks these qualities and enter his name on the line marked lowest. Select the officer who seems about half way between the two previously selected and who represents about the general average in physical qualities; enter his name on the line marked middle. Select the officer who is half way between the middle and the highest; enter his name on the line marked high. Select the one who ranks half way between middle and lowest; enter his name on the line marked low.

In the same manner make out scales for each of the other four sections (Intelligence, Leadership, Personal Qualities and General Value to the Service).

How to Use the Scale.—Rate your subordinate for physical qualities first. Consider how he impresses his men by his physique, bearing, neatness, voice, energy and endurance. Compare him with each of the five officers in section I of the Rating Scale, and give him the

RATING SCALE

I. PHYSICAL QUALITIES. Physique, bearing, neatness, voice, energy, endurance. Consider how he impresses his command in these respects.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
II. INTELLIGENCE. Accuracy, ease in learning; ability to grasp quickly the point of view of commanding officer, to issue clear and intelligent orders, to estimate a new situation, and to arrive at a sensible decision in a crisis.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
III. LEADERSHIP. Initiative, force, self reliance, decisiveness, tact, ability to inspire men and to command their obedience, loyalty and coöperation.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
IV. PERSONAL QUALITIES. Industry, dependability, loyalty; readiness to shoulder responsibility for his own acts; freedom from conceit and selfishness; readiness and ability to coöperate.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
V. GENERAL VALUE TO THE SERVICE. Professional knowledge, skill and experience; success as administrator and instructor; ability to get results.	Highest..... 40 High..... 32 Middle..... 24 Low..... 16 Lowest..... 8

number of points following the name of the officer he most nearly equals. If he falls between two officers in the scale give him a number accordingly (*e. g.*, if between Low and Middle give him 7, 7½ or 8).

Rate the subordinate in a corresponding manner for each of the other four essential qualifications. Under III (Leadership) and V (General Value to the Service) consider which officer he will most nearly equal *after equivalent experience*.

The total rating for a subordinate is the sum of the ratings you give him in the five separate qualities. If directions are followed carefully, the average of any considerable group of officers rated is about sixty points. In other words, sixty points for a lieutenant means that a captain has compared him with the captains he knows and certifies that after equivalent experience he will be equal to an average captain.

ASSIGNMENT

In order to understand this system thoroughly the student should make a trial scale and rate the qualifications for officers of five of his fellow students. Arrange your work with one or more students so that several will rate the same men. Compare your ratings to see how closely you agree. It has been found from experience that, on the average, officers differ in their ratings of another officer by not more than five points. At Plattsburg recently the average of several hundred candidates differed by less than two points.

TWO CASES OF LONG LATENT MEMORY

BY HOWARD C. WARREN

Princeton University

It is well known that in old age incidents of early life are frequently recalled which have apparently never been brought up meanwhile. The two following cases are reported merely because they are well-authenticated records, and because there is every reason to believe in each case that the experience was completely dormant during the entire period.

I

The writer's father, D. T. W., at the age of 90 years, 5 months, was conversing one evening recently about the peculiar tricks of his own memory. He mentioned his difficulty in recollecting proper names and recent incidents, whereas he was constantly recalling many trivial events of his boyhood. He related that, lying awake the night before, he suddenly recalled a poem which he had recited at the meeting of a boy's club in Haydenville (Mass.) in 1842-3. Thereupon he repeated the following in a declamatory tone quite unusual to him:

[Sam Patch's Leap]

Once more, my Muse, unfold thy radiant wings,
Float thou propitiously o'er me while I sing,
And as I studiously burn the midnight taper,
Guide thou my pen and sanctify my paper.

* * * * *

The throng gathered on the banks of the Genesee
And the thousands stood looking at the torrent below.
Sam was there; he was in spirits, not liquor.
Behold! He makes one glorious leap.

The foregoing copy was not taken at the time, but is a stenographic record of a second repetition a few days later. To the best of my recollection the wording is the same as the earlier rendering. The first four lines are complete and apparently exact with one minor lapse. The rest is fragmentary.

According to his statement my father was about fifteen when he learned and recited the poem. From known circumstances of his

life it certainly could not have been later than his seventeenth year. The interval was therefore seventy-three to seventy-five years. He has been devoted to business pursuits all his life till recently and has never engaged in literary works or made addresses or recitations. He moved from Haydenville soon after and lost touch with his boyhood friends. He had never mentioned either the incident or the club to the family before this. There is therefore no ground for suspecting that the incident was recalled meanwhile. I can find no clue to explain its recall at the present time.

II

The second case, that of J. E. D., father of an intimate friend of the writer, occurred in 1900. The record was made (and dated) on the spot by his son, who reported the incident to me soon after. The suggestion for the recall is an interesting feature of this case.

In 1900, J. E. D. was eighty-three years old and was the oldest living alumnus of Dartmouth College. At this time he received an honorary degree from the institution. He was surprised and pleased at being thus honored. He had been a business man all his life, but had always been literary in his tastes. In the course of conversation about the degree he said to his son: "I wonder if it is because they remember that Freshman oration of mine;" and immediately began to recite as follows:

[*The Athenians*]

In perusing the pages of history, we find the resources of intellect exhausted and the powers of the human mind taxed to the utmost and the most vivid flights of imagination and fancy employed in celebrating the praises and describing the characters of the heroes and inhabitants of ancient Greece; and well may a smile play upon the face of History as she sees the streams of intellect drying up in supplying a pen "plucked from an angel's wing" in describing a people of such character as the Athenians.

Their independence, not subject to the will of Mr. A. or Mr. B., their prodigious, views, their unbounded hopes, their high pretensions, were proofs that they were possessed of a noble and exalted soul. Do we speak of the glorious character of our own country? Compare our borrowed light with that great luminary which has reflected itself over the whole world and affected or almost given birth to the literature and character of every nation enlightened under Heaven.

Athens remains and will forever remain robed in the habiliments of her own glory, an astonishing monument to the eyes of the world.

The oration was delivered at Dartmouth College in the year 1831. The latent period was therefore about sixty-nine years.

Although recited consecutively there are probably certain omissions from the original composition. The speech itself is perhaps of some interest as illustrating the flowery literary style affected in college oratory of that period.

As in the other case there is every reason to believe from the subject's life history that the oration had not been recalled during the intervening period. Indeed, there are several striking points of similarity between the two incidents.

VARIABILITY IN LEARNING

BY L. L. THURSTONE

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It is of some psychological and pedagogical interest to study the distribution of ability of a group of learners at different stages of progress. In this direction we have such questions as the following. Is the distribution of ability for a group of learners symmetrical at all stages of progress? If not, in what direction does it become skewed with practice? At what rate does the change in skewness take place with reference to the units of practice? What is the nature of the relation between practice and the standard deviation of attainment at successive stages of practice? We should be able to express a student's standing at any stage of practice in terms of the standard deviation of the group at that particular stage.

With such questions in mind I have analyzed the learning data for a group of 165 drafted men in Pittsburgh who have been studying telegraphy at the Carnegie Institute of Technology. These students took a receiving test in telegraphy at every meeting of their classes. I had planned to continue filing these records until the physiological limit of each student was in sight, but most of the men suddenly enlisted as radio mechanics in the army and consequently these records can not be carried toward their physiological limits. However, the records so far accumulated cover the first one hundred hours of practice and I shall present them.

In Fig. 1 we have the relation between practice, expressed in terms of hours, and median receiving speed in telegraphy for the group, expressed in terms of words per minute. It is apparent that the relation is linear within the limits of observation, from the twentieth hour of practice to the seventy-second hour of practice. So far our procedure contains nothing new. It is simply a pooled learning curve representing the median progress of the group. The upper curve in Fig. 1 shows the upper quartile receiving speed, plotted against hours of practice. The lower curve shows the corresponding lower quartile receiving speed. These two curves are also linear within the range of observation. The vertical distance

between the median curve and the upper curve at any point is the upper semi-interquartile range of receiving speed at that stage of practice. Similarly for the lower semi-interquartile range.

Two interesting facts appear in this diagram. The variability of the group, here expressed as the quartile range, increases with

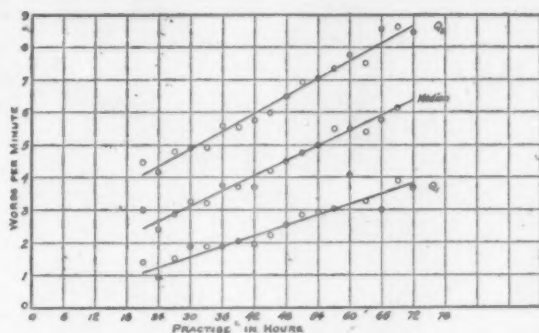


FIG. 1.

practice. This is perhaps to be expected anyway by common sense for if a frequency surface of attainment be plotted at each successive stage of practice, the range should increase with practice while the frequencies should decrease to keep the areas of the curves constant. Hence any measure of variability must increase with practice. Learners separate from each other more and more in attainment as they progress.

The second fact which appears in Fig. 1 is that the two semi-interquartile ranges at any stage of practice are comparable in magnitude. This would not necessarily be so from *a priori* reasoning. This indicates that the frequency surface of attainment is practically symmetrical throughout the range of practice covered by our observations. It does not necessarily follow that the surfaces are normal.

Since the standard deviation is a more acceptable measure of variability than the quartile ranges I have tabulated it for every test of receiving speed. One such test was given at every three-hour meeting of the class. Fig. 2 shows this relation between practice, expressed in terms of hours, and the standard deviation of attainment, expressed in terms of words received per minute. The variability evidently increases with practice. The curve is linear within the range of observations but obviously it can not be expected to continue so because that would lead to infinite variability with continued practice which would be absurd.

In a later article I shall report a similar analysis for the learning of typewriting which I was able to continue well toward the physiological limit. This should make possible the algebraic expression of the standard deviation of attainment as a function of practice.

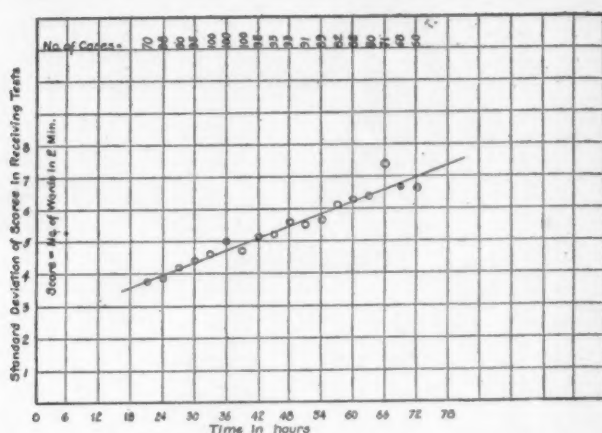


FIG. 2.

The analysis of learning functions by means of the frequency surface at successive stages of practice will unquestionably prove to be profitable in that it will enable us to compare the work of several investigators, a hopeless task with our present unnecessarily anecdotal literature on learning.

MEMORY

BY WARNER BROWN

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All the theories concerning retention in memory between the time of impression and the time of recall are reduced by Larguier des Bancel (8) to the two advanced by Plato: either there is a *trace* remaining, notion of the wax tablet; or the image *survives*, notion of the captive bird. The choice between these views depends upon metaphysical, not psychological, considerations. Baillie (2) claims objectivity for the objects of memory-knowledge and concludes that no theory of knowledge can be adequate which takes its start primarily or solely from our sensorial knowledge of the outside world. For Laird (7) memory has become the meeting point of two dissimilar lines of research, to the reciprocal benefit of the philosophy and psychology of today. This is said by one who thinks that the psychological investigations into memory have received a powerful impetus from the pen of Bergson.

The much discussed experiments of Ebert and Meumann on the transfer of training in memory have been repeated by Reed (13). The practice group consisted of eight subjects. They received an amount of practice on nonsense syllables at least as great as that given by Meumann. The control group consisted of six (later five) persons. Seven tests of memory-span and six tests of learning were performed by both practice and control groups before the practice work and after its conclusion. There were some deviations from the technique of Ebert and Meumann, particularly with regard to the amount of work in practice per sitting and the alternation of the methods of learning. In addition to the methods of scoring employed by Ebert and Meumann several others are used by Reed. When the various methods of scoring are considered, and the amounts of the average deviations, it appears that the small apparent advantage of the trained over the untrained group in the second test is not significant. The data show in the tests of learning ability, as well as in the tests of memory-span, that training in learning nonsense syllables does not give, in dependable amounts, increased ability to learn or to remember other kinds of material.

The experimenter makes the suggestion that results reported by Ebert and Meumann may be due to revival of the practice in memorization which their subjects received during their school days. The paper contains contributions to the questions of whole versus part methods of learning and of the effect of the length of series upon the amount and parts recalled.

An individual study is reported by Aschieri (1) of a normal child of eight years and a subnormal child of sixteen, both of the mental age of ten and equally advanced in school. Memory-span, speed of learning, and quality of reproduction are considered. The most valuable conclusion is that subnormal cases as well as normal possess distinctly individual characteristics and never conform strictly to type. Deaf children in the Ohio State School for the Deaf were found by Pintner and Patterson (12) to be much inferior to normal children in visual memory for digits. Their inferiority in this respect was greater than their performance in other tests would lead one to expect. The visual memory of the congenitally deaf was not as good as that of those children who had had some auditory experience. The investigators are lead to conclude that auditory experience and probably auditory images play an important part in the recall of digits presented visually. A predilection on the part of women for memory work is shown by Gates (3). In a long series of examination questions where an option was given between a question involving reasoning and one depending solely on memory women chose the memory questions more frequently and were relatively more successful in answering them than men. Those women who did choose the reasoning questions were relatively unsuccessful in answering them. Other tests given independently to the same subjects showed the women to be superior to the men in immediate memory and in retention. Tests for recall and recognition of words, geometrical figures and nonsense syllables were applied to 638 children in the fourth to eighth grades by Mulhall (10). She found that both forms of memory improve with age and with school grade, but that the younger children in a grade are somewhat better than the older ones. Girls do better than boys with words and syllables but not with geometrical forms.

Seeking a practical test for the ability to associate peoples' names with their persons Gould (6) allowed his subjects to study the names attached to twenty photographs for five minutes. A high correlation results between the ability to recall these names when the pictures are presented alone and the ability to recall the

names of seventeen strangers who were introduced to the same subjects. According to an experiment by Gordon (5) a musical selection is easier for musical subjects to learn than a series of nonsense syllables constructed by making one syllable correspond to each note and presented in the same tempo. But non-musical subjects find the syllables easier to learn. The music was not presented in vocal tones in the manner of the syllables, but was played over on the piano, then sung by the learner, then played again, etc. That the arrangement of the music facilitates the learning process is shown by the increased difficulty of learning the notes presented in reverse order. Myers (11) finds that normal school girls one year after completing a high school course in history are able to associate some fact correctly with forty-five per cent. of a list of names of persons notable in American history. The order of success in the memory test corresponds fairly well with the frequency with which the names are mentioned in text books in the case of military names but not in the case of civilians. This study is one of a series intended to measure the progressive loss in memory for the same individuals over a period of several years.

Morgan (9) finds by introducing noise into the work room that the formation and retention of connections between syllables and numbers is interfered with to a degree which is not compensated for by the greater effort put forth under such adverse conditions. Recitation as a factor in memorizing is analyzed in a monograph by Gates (4). Experiments were made with children from the first to the eighth grades (about forty in each grade), and with fifteen adults, in memorizing nonsense syllables and sensible material consisting of brief biographical statements. The amount to be studied always exceeded what could be learned in the time allotted. The effects of practice, time of day, inequality in test material, individual differences and other possible disturbing factors were controlled by dividing each group of subjects up into squads among whom the successive tests were assigned in such sequence as to equalize all of these factors. The material was studied either by continuously reading over and over or by a certain amount of reading followed by attempted silent recitation with correction by reference to the copy in hand. The amount of time devoted to reading ranged from 100 per cent. down to 20 per cent. by steps of 20 per cent.; and in the case of sensible material down to 10 per cent. The results show a marked advantage for recitation, increasing steadily as the proportion of time devoted to reading is reduced,

until not more than one fifth or two fifths of the time is devoted to reading. The advantage of recitation is greater for recall delayed three or four hours than for immediate recall, and greater for non-sense than for sense. Analysis shows an advantage for recitation arising from articulation, accent and rhythm, localization, the noting of meaning and relations with unusual characteristics of the material, grouping, confidence from testing, increased satisfaction from knowledge of success and absence of monotony. Memorizing with recitation is shown to conform much more closely to the normal process of sensory-motor learning than does memorizing by a series of visual impressions.

REFERENCES

1. ASCHIERI, E. Esperienze sulla memoria. *Riv. di Psicol.*, 1917, 13, 191-204.
2. BAILLIE, J. B. On the Nature of Memory-knowledge. *Mind*, 1917, 26, 249-272.
3. GATES, A. I. Experiments upon the relative Efficiency of Men and Women in Memory and Reasoning. *Psychol. Rev.*, 1917, 24, 139-146.
4. GATES, A. I. Recitation as a Factor in Memorizing. *Arch. of Psychol.*, 1917, No. 40. Pp. 104.
5. GORDON, K. Some Tests on the Memorizing of Musical Themes. *J. of Exp. Psychol.*, 1917, 2, 93-99.
6. GOULD, R. L. A Test for Memory of Names and Faces. *J. of Appl. Psychol.*, 1917, 1, 321-324.
7. LAIRD, J. Recollection, Association and Memory. *Mind*, 1917, 26, 407-427.
8. LARGUIER DES BANCELS, J. La conservation des images et les théories de la mémoire. *Arch. de Psychol.*, 1917, 16, 349-356.
9. MORGAN, J. J. B. The Effect of Sound Distraction upon Memory. *Amer. J. of Psychol.*, 1917, 28, 191-208.
10. MULHALL, E. F. Tests of the Memories of School Children. *J. of Educ. Psychol.*, 1917, 8, 294-302.
11. MYERS, G. C. Delayed Recall in American History. *J. of Educ. Psychol.*, 1917, 8, 275-283.
12. PINTNER, R., & PATTERSON, D. G. A Comparison of Deaf and Hearing Children in Visual Memory for Digits. *J. of Exp. Psychol.*, 1917, 2, 76-88.
13. REED, H. B. A Repetition of Ebert and Meumann's Practice Experiment in Memory. *J. of Exp. Psychol.*, 1917, 2, 315-346.

